
A pre-clinical murine model of oral implant osseointegration.

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Public Summary:

Dental implants are used to replace missing or diseased teeth. In this paper, we develop a mouse model of dental implant "osseointegration", a name given to the process by which the metal implant is stabilized by bone formation in the mouth. We use this model to show the importance of bone-forming signals, such as Wnts, and how they can be used to potentially accelerate implant osseointegration and allow patients to more rapidly recover from the dental implant surgery.

Scientific Abstract:

Many of our assumptions concerning oral implant osseointegration are extrapolated from experimental models studying skeletal tissue repair in long bones. This disconnect between clinical practice and experimental research hampers our understanding of bone formation around oral implants and how this process can be improved. We postulated that oral implant osseointegration would be fundamentally equivalent to implant osseointegration elsewhere in the body. Mice underwent implant placement in the edentulous ridge anterior to the first molar and peri-implant tissues were evaluated at various timepoints after surgery. Our hypothesis was disproven; oral implant osseointegration is substantially different from osseointegration in long bones. For example, in the maxilla peri-implant pre-osteoblasts are derived from cranial neural crest whereas in the tibia peri-implant osteoblasts are derived from mesoderm. In the maxilla, new osteoid arises from periosteum of the maxillary bone but in the tibia the new osteoid arises from the marrow space. Cellular and molecular analyses indicate that osteoblast activity and mineralization proceeds from the surfaces of the native bone and osteoclastic activity is responsible for extensive remodeling of the new peri-implant bone. In addition to histologic features of implant osseointegration, molecular and cellular assays conducted in a murine model provide new insights into the sequelae of implant placement and the process by which bone is generated around implants.

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